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Pressure, weather and rainfall of 1936

Variations of Pressure near the British Isles during 1936

Pressure over the North Atlantic and western Europe during 1936 showed a considerable degree of variability. Over the British Isles the general distribution during the first three months was almost continuously cyclonic, but later in the year an anticyclonic type occurred with increasing frequency.

Unsettled cyclonic weather set in about December 26th, 1935, and January gave a record low mean pressure at many places in the British Isles. At Southport the mean of 997·3 mb. was the lowest for any month since before 1871, with the exception of December, 1876. The average was below 990 mb. from January 1st–10th over Ireland and from January 17th to February 2nd over Scotland. Pressure again averaged less than 995 mb. over Scotland from February 15th–24th. The only interruptions were brief periods of more anticyclonic type from January 11th–16th and March 15th–18th: the average for the whole quarter (Fig. 1) shows a quite considerable area of low pressure centred over Ireland, the mean for Malin Head being 1001·8 mb.

A complete change of type set in at the beginning of April. From April 1st–19th the British Isles came under the influence of anticyclones, at first directly over the country and later further north, giving predominantly northerly winds. The last part of April brought exceptionally high pressure (exceeding 1030 mb.) over the Azores

and mainly westerly winds in the British Isles. Easterly and northerly winds returned at the beginning of May, however, and continued throughout the month. June opened with the Azores anticyclone extending north-eastward across the British Isles, giving divergent westerly winds in Great Britain, but from the 18th to 28th an anticyclone lay definitely over Scotland. Thus the second quarter of 1936 showed anticyclonic conditions over and near the British Isles, almost as persistent as the cyclonic conditions of the first quarter. For the three months the average pressure was about 1016 mb. along a ridge from Spain across the British Isles to Scandinavia.

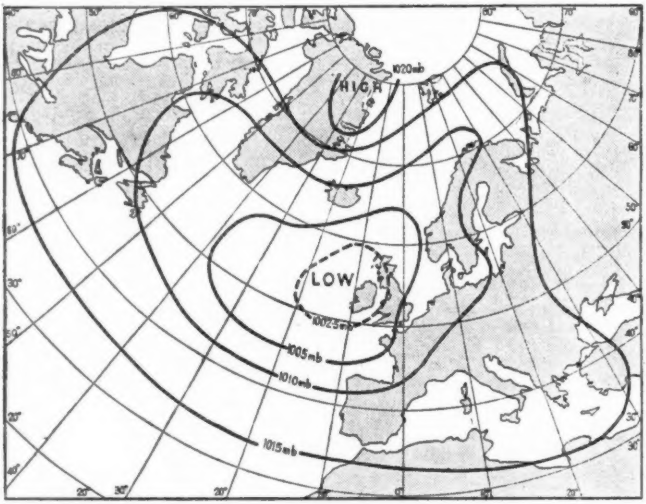


Fig. 1.—Pressure Averages, January–March, 1936

The pressure variations of the third quarter, July to September, were very marked, and the choice of holiday periods was even more of a lottery than usual. From June 29th to July 27th there was a long period of very disturbed weather, the net result being an area of low pressure (below 1005 mb.) centred over Scotland. From July 28th to the end of August there was a great improvement; the average chart for July 28th to August 21st shows a westerly type, with generally high pressure, especially in the south, and divergent isobars over the British Isles, a distribution favourable for dry weather over England and one characteristic of the great drought of 1921. During the last ten days of August an intense anticyclone was centred directly on England, with average pressures above 1025 mb. over the whole country.

The first ten days of September brought a complete reversal, with an area of pressure below 1005 mb. over Scotland and Ireland, but anticyclonic conditions returned on September 11th and remained with a few interruptions until October 13th. From September 11th–30th a powerful anticyclone covered the greater part of Europe, and the British Isles on the western fringe were disturbed from time to time by the passage of shallow depressions, but from October 1st–13th the high-pressure centre lay directly over Great Britain.

The five weeks from October 14th to November 17th were marked by an intense westerly type of weather, with frequent depressions passing across or to the north of Scotland. The average chart for October 14th-31st was reproduced in the *Meteorological Magazine* for November, p. 226; that for November 1st–17th is almost identical. From November 18th–29th the whole system lay further north, with a mean pressure of 988 mb. over Spitsbergen, while an anticyclonic ridge extended from the Azores across the British Isles to Russia. This period was notable for persistent dense and widespread fogs.

On November 30th the westerly-cyclonic type returned, and continued during the first three weeks of December with frequent depressions passing over or near the British Isles causing widespread gales. Some very low barometer readings were recorded, especially on the 14th and 16th, when two intense centres with pressures below 952 mb. passed between the Faroes and the Shetlands. The chart of mean pressure for December 1st–21st shows a centre about 985 mb. east of Jan Mayen, with a steep gradient across northern Europe to an anticyclonic ridge which exceeded 1030 mb. over the Urals.

During the last ten days of December conditions over north-western Europe were much quieter. The centre of low pressure had returned north-east to Spitsbergen with secondaries over southern Greenland and north-eastern Russia (at Sverdlovsk the average dropped from 1030 mb. for December 1st–21st to 995 mb. for December 22nd–31st), while the anticyclone was centred over the Rhineland, where pressure reached 1033 mb. The British Isles still lay under the influence of a westerly type of weather, but much more stable, fine and mild.

C. E. P. Brooks.

The Weather of 1936

Complete information is not yet available, but as far as can be ascertained at present the year 1936 was dull and wet, on the whole, in England and Wales; on the other hand, locally in the northern half of Scotland sunshine exceeded the average and rainfall was deficient.

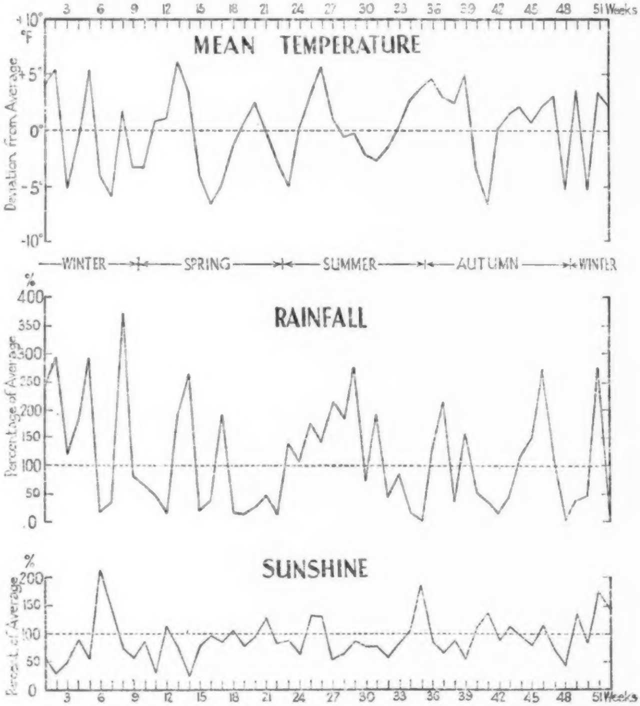
Among notable features of the weather of the year may be mentioned extensive floods in England in early January, a long drought locally

in south and east England during the end of April and first three weeks of May, and unusually frequent thunderstorms, accompanied locally by large hailstones and intense falls of rain, in June and July. The bad impression of the summer holiday period created by a wet, dull and, in southern districts, cool July, was somewhat modified later by a dry August, with warm days and abundant sunshine during the latter part of the month. The period covering the latter half of October and the first half of November was remarkable for strong winds and frequent gales, the gale of October 26th–27th being very violent, while the persistent and sometimes dense fog which was widespread from November 19th–28th will long be remembered particularly in parts of northern England and the Midlands. In the closing month of the year, extensive and destructive floods resulted from the heavy rains of December 13th–15th, but mild, dry and sunny periods were enjoyed at times in many parts during the Christmas holiday season.

Considering the British Isles as a whole, January, February, June, July, September and November were wet, January and July notably so. The spring months, March to May inclusive, were all dry as was October, while August was exceptionally dry. At Oxford, the drought of 25 days ending May 21st was the longest on record for this time of year. July was the wettest on record at a number of stations and, in strong contrast, August, 1936 was the driest August at numerous stations of long standing in the south and west of England. Details for each month are given on p. 283.

Mean temperature for the year differed little from the average, but marked deviations from the average occurred in different periods. Interesting cold spells include January 12th–23rd, February 3rd–5th and 8th–14th, October 4th–10th and November 22nd–25th. Some unusually low screen minima were recorded during the earlier periods ; for example, 5° F. was recorded at Braemar on February 5th and 13th, 6° F. at Logie Coldstone on January 20th and at Balmoral on February 5th and 13th and 7° F. at Rickmansworth on February 12th, at Braemar on January 19th and at Balmoral on January 20th. At Shoeburyness on February 11th a thin layer of ice formed on the sea and extended 20 ft. out. Temperature remained below 32° F. all day locally in England on November 22nd, 23rd and 24th. April was the coldest month of that name at West Kirby since 1917 and at Hampstead, Ross-on-Wye and Teignmouth since 1922 ; the first week of June was exceptionally cool, screen minima of 25° F., 26° F. and 26° F. being registered at Dalwhinnie, Braemar and Balmoral respectively on the 5th, while the maximum temperature at West Kirby on the 3rd, 46° F., was the lowest in June since records began in 1904. The coolness of July in southern districts was mainly due to persistently cool days, the absence of really warm days being a striking feature of the month. On the other hand, March 19th–31st was notably mild, June 19th–22nd very warm (some of the highest

temperatures of the year being recorded on June 20th and 21st), and August 23rd to 31st was also very warm, though a large diurnal range occurred at times. The first 25 days of September were warm, the nights as well as the days being mild ; the highest minimum of the year was recorded at numerous places during this spell, while the mean minimum for the month at Oxford was the highest there for September since records were first taken in 1881.



THE WEATHER OF 1936 IN SOUTH-EAST ENGLAND
Weekly variations from long period averages computed from observations at five representative stations

The large deficiency of sunshine over most of England and parts of Ireland and southern Scotland was a feature of the weather of the year ; the total sunshine at Eastbourne was the lowest since 1913 and at Ross-on-Wye since 1920, while the totals were the lowest on record at Croydon, Lympne and Shoeburyness since observations were first taken in 1922, 1921 and 1919 respectively. In parts of

northern Scotland, however, there was a marked excess; at Aberdeen the excess amounted to 135 hours and at Stornoway to 99 hours. For the British Isles as a whole the sunniest months, compared with the average, were February and October, and the dullest March, July and September. June was exceptionally sunny in the east and extreme north of Scotland; at Aberdeen the total, 274 hours, was the highest monthly total ever recorded in a record back to 1881. In Scotland, northern England and at certain stations in north Ireland, sunshine was very excessive in April; at Wakefield, Yorkshire it was the sunniest April since 1921. Abundant sunshine was also enjoyed for the most part from August 22nd–29th while in east and south-east England sunshine was markedly excessive in December. On the other hand, March, July and September were exceedingly dull; at Southport and Phoenix Park it was the dullest March in records back to 1892 and 1881 respectively; at Birr Castle it was the dullest July since before 1881 and at Oxford and Kew Observatory, September was the dullest month of that name in records back to 1881 and 1880 respectively.

Strong winds and gales were fairly frequent. In a severe gale on January 9th, speeds of 92 m.p.h. and 91 m.p.h. were registered in gusts at Bidston and the Lizard. On February 10th–11th a widespread and notable gale was reported in England and Ireland, 92 m.p.h. being registered in a gust at Valentia and 90 m.p.h. at Pendennis Castle on the 10th. As a rule gales are infrequent in southern England in July and in consequence the gale of July 18th was noteworthy. The period covering the latter half of October and the first half of November was very disturbed, with frequent strong winds and gales; the gale of the night of October 26th–27th was destructive and unusually severe, gusts of 104 m.p.h. and 94 m.p.h. being registered at Tiree and Bell Rock Lighthouse on the 26th and 95 m.p.h. at Paisley on the 27th. On November 30th a gust of 92 m.p.h. was registered at Lerwick and notable gales occurred at times also in December; gusts exceeding 90 m.p.h. were registered at Tiree on the 4th, 16th and 17th.

The diagram on page 281 shows the weekly variations in temperature, rainfall and sunshine in south-east England in 1936. The variations are given in the form of deviation from the average of temperature and percentages of the average of rainfall and sunshine. The district value is the arithmetic mean of the values for the following stations:—Kew Observatory, Margate, Hastings, Southampton and Marlborough.

L. F. Lewis.

The Rainfall of 1936

Provisional estimates of the general rainfall for 1936 are given below, both in actual inches and as percentages of the average:—

	in.	per cent.
England and Wales	38·5	109
Scotland	48·4	96
Ireland	44·6	103
British Isles	43·6	105

Over England and Wales, 1936 was slightly drier than 1935; over Scotland, 1936 ranks as the driest year since 1922 with the one exception of 1933; over Ireland, 1936 was wetter than either 1935, 1933 or 1932, and over the British Isles as a whole, 1936 was not as wet as 1935, although wetter than 1934.

General values for each month are set out in the table below, both as percentages of the average and in actual inches of rainfall.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	%	%	%	%	%	%	%	%	%	%	%	%
England and Wales ..	178	127	90	96	53	151	191	39	142	62	121	90
Scotland	140	87	71	54	65	74	150	70	119	105	81	107
Ireland	148	93	86	73	61	115	197	45	140	72	104	104
British Isles	163	112	85	81	58	124	182	48	136	75	107	97
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
England and Wales ..	5·3	3·3	2·4	2·0	1·2	3·7	5·5	1·3	3·6	2·5	4·2	3·5
Scotland	6·9	3·6	2·9	1·6	2·0	2·1	5·7	3·1	4·8	5·1	4·3	6·3
Ireland	6·0	3·3	2·9	2·0	1·7	3·2	6·6	1·9	4·4	2·9	4·5	5·2
British Isles	6·2	3·6	2·7	2·0	1·5	3·3	5·9	1·9	4·2	3·2	4·5	4·6

The wettest months of the year were January and July with 6·2 in. and 5·9 in., and the driest months May and August with 1·5 in. and 1·9 in. respectively. In February the rainfall slightly exceeded the average, but there were deficiencies in each of the next three months, so that by the end of May the total rainfall was only 0·6 in. in excess of the average. June and July contributed an excess of 3·3 in., but August gave a deficiency of 2·0 in., so that by the end of August the rainfall was only 1·9 in. in excess of the average. The remainder of the year gave a rainfall approximating closely to the average, so that the year ended with an excess of 2·2 in.

J. GLASSPOOLE.

OFFICIAL PUBLICATION

The following publication has recently been issued :—

The measurement of upper winds by means of pilot balloons. (M.O. 396.)

This publication collects in a single pamphlet the hitherto scattered and, in many cases, unwritten instructions in the methods of pilot balloon observations as carried out at Meteorological Office out-stations. In the early sections are contained descriptions of the necessary equipment and instructions regarding its management and preparation for an ascent. The methods of procedure for the single theodolite, tail and night ascents are described, preceded by a section devoted to the fundamental trigonometry on which the computations

of the winds, illustrated by examples, are based. An appendix deals with the care, periodical examination and adjustment of theodolites, which are described with the aid of diagrams.

Discussions at the Meteorological Office

The subjects for discussion for the next two meetings are :—

January 25th, 1937. *On vorticity in the atmosphere as a weather factor.* By S. Fujiwhara and others. (Tokyo, J. Fac, Sci. Tokyo Univ. (Sec. I). Vol. 3, Pt. 2, 1935, pp. 65–106.) *Opener.*—Mr. W. R. Morgans, M.Sc.

February 8th, 1937. (a) *The importance of the stratosphere as regards the "Grosswetterlage".* By F. Baur. (Met. Z. Braunschweig, 53, 1936, pp. 237–47). (In German.) (b) *Official weather forecasting for 10-day periods in Germany.* By F. Baur. (Worcester, Mass., Bull. Amer. Met. Soc., 17, 1936, pp. 148–52, 252–4.) *Opener.*—Sir Gilbert Walker. C.S.I., F.R.S.

Royal Meteorological Society

The monthly meeting of this Society was held on Wednesday, December 16th, in the Society's rooms at 49, Cromwell Road, South Kensington, Dr. F. J. W. Whipple, F.Inst.P., President, was in the Chair.

The following papers were read and discussed :—

E. W. Hewson, M.A.—The application of wet-bulb potential temperature to air mass analysis, II.

In this paper, the horizontal component of the motion of air in a depression has been traced approximately by means of upper wind and high cloud observations, and by the pressure distribution at 2Km. and 5Km., and the vertical component found by the use of wet-bulb potential temperatures. The trajectories found in this way show clearly that there is considerable horizontal divergence in the warm air ascending at the warm front of a depression. A study has also been made of the changes which occurred in the humidity mixing ratio x.

R. M. Poulter.—The presentation of visibility observations.

The range of distance embraced by a visibility number used at meteorological stations varies roughly as the lower limit of the range, so that one occasion in a year of visibility 3 (500m.–1Km.) is twenty times as significant as one occasion of visibility 7 (10–20Km.), and so on. Accordingly, frequency curves characteristic of six types of meteorological stations in the British Isles, judged by the surrounding country, have been drawn by plotting the number of occasions per kilometre (n/d) covered by each visibility number. The 54 curves refer to 7h., 13h., and 18h. for summer, winter, and the year for stations grouped in the following categories :—

Coastal—clean air.	Inland—clean air.
clean air with sea fogs.	polluted air, rural.
polluted air.	polluted air, urban.

and show marked seasonal and diurnal variations.

C. J. Boyden, B.A.—The formation of coloured rain.

An examination is made of the meteorological conditions leading up to a thunderstorm which gave heavy falls of coloured rain in Shetland on March 16th, 1935. Evidence is given that the instability was caused in an air mass which was initially very stable, by forced ascent through the undercutting by denser air. The rare combination of conditions described is consistent with the scarcity of coloured rain in this country. The hypothesis put forward for the particular case of the Shetland thunderstorm is suggested as applicable to the more common " red rain " originating in desert areas.

D. Lloyd.—Rainfall over the Rivington catchment area.

The paper's purport is to describe shortly the rainfall over the Rivington catchment area and its disposal. The probable frequency of dry periods is sought by examining the variance (as defined by Fisher). The relation of stream discharge to precipitation is mentioned with a view to analysing effective rainfall as a function of climate in a further stage.

Correspondence

To the Editor, *Meteorological Magazine*

Saline Deposit by Strong Winds

From time to time the occurrence of sea salt blown inland by strong winds has been put on record and I read in the *Meteorological Magazine* for November, 1936, p. 235, that salt has been found on the sun recorder sphere by Mr. F. J. Parsons at Ross-on-Wye.

In addition to the effects already reported, such as crystals on windows, and the effect on power lines, I should like to call attention to a fresh effect which I believe has not been reported before.

In the *Gardeners' Chronicle*, Vol. 100, 1936, p. 341, is reported a biological effect on plant growth, observed by my father, Mr. S. Ashmore. Young sycamores were found with leaves badly shrivelled, those most exposed being the most shrivelled. A lesser amount of damage was done to thorn hedges, elm trees and hardy fuchsias. The damage was discovered after the gale of October 19th, 1936. We are situated in the Clwyd Valley, which runs north-north-west to the sea, with mountains on either side. Anemometer records from Sealand show that the highest hourly wind was from 290° at 48 m.p.h. and the highest gust was 70 m.p.h. This shows that the wind blew straight up the valley from the sea, and at such a speed it should be easy for sea-spray to be transported.

Llannerch is $6\frac{1}{2}$ miles from the sea at its nearest point. Other reports have been received of vegetation having been damaged at similar distances. Mr. L. E. Alder reports that after a gale in the

early autumn of 1935 at Kilkhampton, Devon, runner beans were killed 3 miles from the coast by sea-salt, and that in the early autumn of this year at Holsworthy, Devon, a gale brought in sufficient salt to scorch sycamores and ash trees 10¼ miles inland.

Mr. G. Haig (*Gardeners' Chronicle*, Vol. 100, 1936, p. 377) reports damage to plant life near Hastings as far as 20 miles inland after a severe gale early in October, 1935.

One theory tries to explain the damage on this occasion as due to sand particles brought with great force against the leaf surface. But at Hastings this explanation fails since apparently there is little sand on the beach there; it is mostly pebbles. If salt is responsible I suggest that it is due to the osmotic pressure of a strong solution of salt in contact with the surface of the leaves.

S. E. ASHMORE.

Llannerch Gardens, St. Asaph, Flintshire, North Wales, December 16th, 1936.

Night Radiation and Fog associated with different types of pressure distribution

Night minima from thermometers exposed at different levels near the ground present some curious differences during foggy weather,* and data recently obtained during fogs associated with different sources of air supply show some interesting contrasts.

The attached figures show curves of deviation from the screen minimum, of minima from standard thermometers exposed at various levels above the ground. The curves in Fig. 1 are typical of "radiation nights" such as are usually associated with a clear, calm atmosphere.

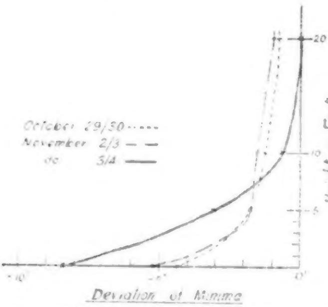


FIG. 1—MARITIME CYCLONIC FOGS

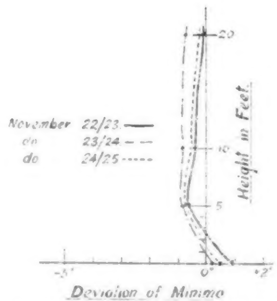


FIG. 2—CONTINENTAL ANTICYCLONIC FOGS

The air over southern England on these nights was derived from the Atlantic Ocean, being within westerly currents associated with Icelandic depressions. The fogs were relatively dry, though a little

* See *Meteorological Magazine*, 71, 1936, p. 129.

dew was deposited in each case. The fog on the night of November 3rd/4th though fairly dense horizontally, had no great vertical depth, the sky in the zenith being faintly visible from the anemometer mast at a height of 20 ft. from the ground. The surface wind was light, the mean velocity for the eight hours ending at 7h. on the morning of the 4th being only 2·9 m.p.h.

Vertically, the fog being relatively thin and the wind light, there was little hindrance to radiation, hence the pronounced inversion of minima in the lower layers of the fog.

In marked contrast, the air in the case of the curves in Fig. 2 was of continental anticyclonic origin, being mainly derived from a large anticyclone over Europe, with extensions to the north of the British Isles.

The fog on the night of November 22nd/23rd gave a thick deposit of rime, the ice on the windward side of the anemometer mast approaching 1/16 in. in thickness. This fog was of greater vertical depth, the sky being totally obscured, and the wind velocity was 0·5 m.p.h. higher than in the case of the night of November 3rd/4th. In spite of this, and the fact that the earth temperature at 12 in. depth was 5° F. lower than in the former case, the minimum on the grass was 0·9° F. higher than that in the screen. On the other hand, the deviation at 5 ft. was negative, the minimum being 1·5° F. lower than at the surface ; and from the former level upwards to at least 20 ft., the minima show little change, and it is curious that with a higher wind velocity, the layer near the ground maintained a higher temperature.

It would seem that the greater depth of the fog acted as a check on radiation and that a warmer layer of air formed like a " skin " at ground level, beneath the fog.

These conditions were repeated on the two following nights, but the deviation of the grass minimum was reduced to + 0·2° F. and + 0·5° F. respectively, and no rime was deposited.

The great difference between these two types of curve is obviously something more than mere chance, and although superficially similar, from these results it would seem that night radiation, from objects exposed in fog, assumes different characteristics in maritime cyclonic air, as distinct from continental anticyclonic air.

The higher moisture content of the latter in the case of the night of November 22nd/23rd, as evidenced by the heavy deposit of rime, seems worthy of comment.

DONALD L. CHAMPION.

7, Robinson Avenue, Goff's Oak, Herts, December 1st, 1936.

NOTES AND QUERIES

Heavy Rainfall at Hongkong

Fig. 1 is a reproduction of a record obtained from a Dines Tilting Syphon rain-gauge at the Regional Seminary, Aberdeen, Hongkong,

which has been kindly forwarded by Father P. J. Howatson, S. J. for reproduction. The record was obtained on August 1st–2nd, 1936, the fall for the 24 hours, 11h.–11h., at the Royal Observatory, Hongkong being recorded as 222·4mm. (8·76 in.). Father Howatson has recently started the observations at the Regional Seminary and in his covering letter he explains that the gauge had only just been unpacked and set in the ground when the downpour occurred. This explains the fact that the gauge was not in perfect adjustment as shown by the record. The fall occurred in a thunderstorm at the

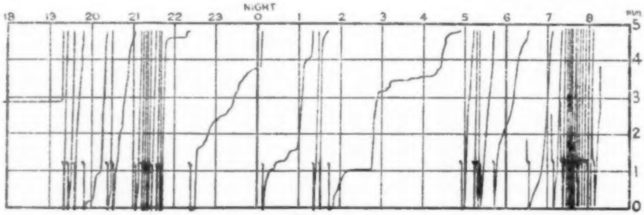


FIG. 1

tail end of a typhoon which turned north when within about 150 miles of Hongkong. During the most intense period of fall the record shows that 65mm. (2·56 in.) fell in a little under an hour between 7h. 20m. and 8h. 20m. on August 2nd.

A fall of 8·76 in. is not heavy compared with some of the enormous downpours on record in the wettest parts of the world. On June 14th–15th, 1911, a total of 1168·1mm. (45·99 in.) fell at Baguio, Philippine Islands, in 24 hours from noon to noon. Fortunately this fall was recorded on a Friez pluviograph, which works on a tilting bucket principle. Other falls however, such as that of 40·8 in. at Cherrapunji, India, on June 14th, 1876, depend on eye readings only. Autographic records of intense falls are sufficiently rare to make that of the storm at Hongkong of sufficient interest for publication.

REVIEWS

Singularitäten des Davoser Klimas. By G. Riedel. Reichsamt für Wetterdienst, Wissenschaftliche Abhandlungen, Band I, No. 5, *Illus.* Julius Springer, Berlin, 1936.

The mountain station of Davos in Switzerland, at a height of 5,120 ft., has climatically a very favourable situation, being sheltered to the north-east and above the level of the fogs and clouds of winter. In this paper G. Riedel makes an interesting comparison of the annual variation of temperature in this valley station with that at the freely exposed station of Zugspitze, at a height of 9,720 ft. The general trend of the two curves differs appreciably ; at Davos, on account of

its sheltered situation, temperature begins to rise much earlier in spring and continues to fall much later in autumn, but the minor irregularities of temperature at the two stations show considerable agreement. These are the "singularities" of the title; they are analysed in detail and associated with sunshine, precipitation and wind direction or air mass. Owing to the configuration of the narrow valley, there are practically only two wind directions at Davos, south-west and north-east. The work ends with summaries and diagrams of frequencies of temperatures and temperature changes.

Snow structure and ski fields. By G. Seligman, B.A. With an appendix on Alpine Weather by C. K. M. Douglas, B.A. Medium 8vo. pp. xii + 555, *Illus.* London (Macmillan and Co.), 1936. 25*s.*

This book is written primarily for the ski mountaineer—to help him to avoid avalanches. To quote the author's own words, he aims at setting down "with very full illustrations all the known factors which influence avalanche development *both practical and theoretical*—a report of progress, as it were, upon which the scientific investigator can build and from which the practical man can cull the facts he wishes to keep in mind." The result is a valuable book of reference containing a summary of present knowledge of snow, including the author's own contributions, and a comprehensive bibliography of the literature on the subject. The book is divided into three parts: the first discusses the physical and mechanical processes involved in the snow cover of the mountains, the second, the conditions favouring avalanche development, and the third classifies the different types of avalanches and indicates the best tactics to adopt when danger threatens.

After describing the apparatus used in the author's practical work, Part I opens with descriptions of the various forms of solid water found in nature. The author points out that the nomenclature and classification of these forms are at present rather unsatisfactory. In English writings there is a paucity of terms, and in German writings confusion sometimes arises by the use of the same term for different phenomena. The English word hoar frost, for example, covers all the different kinds of sublimed deposits of water vapour on fixed objects; the author subdivides this into surface hoar, depth hoar (a deposit which grows beneath the surface of the snow and with which is associated "crevasse hoar") and air hoar, wind-oriented and free growing. These subdivisions are perhaps too detailed for ordinary meteorological purposes, but appear to be useful in practical snowcraft, owing to the different roles played by the phenomena; for example, surface hoar provides a good running surface for ski and protects the snow beneath it, and depth hoar is likely to contribute to the release of an avalanche. Rime is given three sub-divisions, and the word "arien" is introduced to cover

all deposits of hoar and rime. In his snow terminology the author uses the word " snowflake " for all snow in the act of falling, and " fallen snow " as a group name for all snow lying on the ground before it becomes glacier ice ; the latter is sub-divided into powder snow, which is again sub-divided into new, settling and settled, and old snow which is sub-divided into new firn (including sun and wind crust) and advanced firn. The use of the term " granular snow " in the International Cloud Atlas as a translation of the precipitation form *Reifgraupeln* is described as misleading in view of the many forms of granular snow found in the snow cover on the Alps, for example, the type called *Kornschnee* by the Swiss.

The changes which are continually taking place in the snow particles after they have fallen are described in detail in Chapters V to VIII. A feature of this part of the book is the collection of microphotographs of snow in its various stages from the snowflake just fallen until it has become advanced firn snow. Chapter VIII describes interesting laboratory experiments which show that wind-packing of snow occurs in a moist wind ; comments on the author's work by such authorities as Sir William Bragg, Sir George Simpson, C. S. Wright and L. G. Dobbs are quoted.

The last chapters of Part I deal with the mechanical effects of wind on the snow—the shapes taken up by the snow cover due to eddies produced by wind blowing over obstacles, in particular snow cornices are very fully discussed in Chapter X, and the causes of the various ripplings and markings in the snow.

In Part II the different factors influencing avalanche development are discussed. First, regarding the shape of the mountain side we learn that slopes steeper than 22° should be suspected, but this angle should not be regarded as a hard-and-fast border line, a slope is more dangerous if it is of uniform gradient than if it is broken up by irregularities and terraces, convex slopes are in general more dangerous than concave slopes. Secondly, the anchorage supplied by the underlayer must be considered—scree and boulders are safe, so is mown grass, but long grass is dangerous ; most often, however, the underlayer is snow, and it is important to know the history of this snow cover before an estimate can be made as to whether or no it will afford a good anchorage for a new fall; to quote the author—" I want to stress . . . the extreme importance of knowing the conditions under which the more important and especially the last two falls of snow took place. With this knowledge we can tell whether conditions in the mountains can be presumed safe or suspicious." A third factor is the thickness and weight of the snow cover, and a fourth the internal cohesion of the top layers of snow. With reference to the last, the well-known fact that new snow does not avalanche as a rule until some hours after it has fallen and that then the mountains are unsafe for a few days until the snow has settled, can be explained by a study of the microphotographs of snow in the different stages of

firnification. When snow has just fallen and is still in the feathery stage, the rays of the different particles can interlock ; as the rays become blunt and disappear the particles can no longer interlock and there is little cohesion until the flakes have disappeared and the snow has become granular, when the grains lying close together again give some cohesion. The rate at which these stages are arrived at depends on the weather ; high temperature after a fall will speed up the process, while abnormal cold may delay the safe stage for a week or more.

The wind caused by an avalanche, the avalanche blast, is described as capable of doing more material damage than the snow, in fact " its power is unbelievable " ; and it can travel to great distances. It sometimes brings down avalanches on the opposite side of a valley.

In Part III avalanches are classified, according to their behaviour, into four main groups—dry snow, wet snow, wind slab and ice. The characteristics of the different types are described and the conditions under which they are likely to occur are examined. A chapter is devoted to tactics on avalanche ground. Again, in the chapter on " Safety in the mountains, " the importance of a knowledge of the past weather is emphasised. The author keeps his own record of weather in the Alps, observing, twice daily, wind direction and force, maximum and minimum temperature, and relative humidity ; he considers the trouble taken amply repaid by the help the records give him in understanding the snow conditions.

The short appendix on " Weather conditions in the Alps," by C. K. M. Douglas, contains a good deal of practical information in a few pages.

The keen interest of the author in his subject " gets across " and makes the book excellent reading. It contains a great deal to interest the scientific investigator, while to the winter-sports enthusiast, intending to make excurions on ski, its information is invaluable. There are nearly 400 illustrations, many of them very beautiful ; a notice on the jacket of the book claiming that they " constitute without question the finest and largest collection of snow and ice photographs in existence " may well be justified.

E. H. GEAKE.

A view of the structure of the Muroto typhoon. By Tadao Namekawa and Shiichi Aoki. Reprinted from Mem. Coll. Sci. Kyoto, Series A, Vol. XIX, No. 2, 1936.

The authors of this paper are of the opinion that in the case of the very severe typhoon which passed over Japan on September 21st, 1934, the so-called " Muroto typhoon," a secondary of great intensity, developed within the main system when the latter was in a position just south of Japan. They contend that this secondary system was of the tornado type but on a much larger scale, and that it was

very short-lived. It must be confessed that the authors' reasoning is not easy to follow, nor is the reviewer convinced that it is in all respects sound.

The Muroto typhoon certainly seems to have exhibited certain peculiarities, and though the authors' explanation of these peculiarities may be the true one yet the reviewer cannot help feeling that there may well be other more plausible explanations. At the same time there is no doubt that the authors have studied the typhoon in question in great detail and therefore their conclusions ought not to be lightly set aside.

A. E. M. DODINGTON.

BOOKS RECEIVED

Summary of the Meteorological Observations made at the Meteorological Stations in the Netherlands West Indies during the year 1934 *and the year* 1935, compiled by the Royal Dutch Meteor. Inst., The Hague, 1935 and 1936.

Anales del Observatorio Nacional de San Bartolomé en los Andes Colombianos. Observaciones Meteorologicas de 1932 *y* 1933. Bogota 1935 and 1936.

OBITUARY

Wilhelm Schmidt.—The national meteorological service of Austria has in recent years suffered severely by the loss of its distinguished chiefs. It seems only yesterday that we were sharing with our colleagues in Vienna the loss of F. M. Exner and now comes news of the sudden death of his successor Wilhelm Schmidt on November 27th. The blow is the more severe to meteorologists in Great Britain because we had him with us in Edinburgh and London as recently as September last, when he was full of spirit and energy and appeared to have completely recovered from his recent illness.

Wilhelm Schmidt was only fifty-three at the time of his death; but he had long held a leading place amongst European meteorologists. He has published many papers, commencing in the first decade of this century with communications on the upper atmosphere and ending with recent papers on microclimatology, a subject which he took up with great energy; but his name will go down in meteorological history linked with that of G. I. Taylor as the discoverer of the role played by turbulence or *Austausch* in the processes of the atmosphere.

Probably largely as a consequence of working together with E. Gold in Vienna, when both were young men and keen on the new meteorology brought to birth by the discovery of the stratosphere (or isotherm layer as it was then called), Schmidt always had friendly feelings for British meteorologists and visited this country on several occasions. In 1910 he described his work on atmospheric waves before the British Association at Sheffield. In 1934 he came to

England and delivered a lecture before the Royal Meteorological Society dealing with local climatology in the mountains of Austria, and later in the same year he was back again to lecture before the Royal Aeronautical Society on turbulence near the ground.

In October, 1935, the President of the Royal Meteorological Society announced that Schmidt had been awarded the Symons' Gold Medal for 1936, an honour greatly appreciated by him.

Meteorology owes a great deal to Schmidt and not least that since 1930 he has, in collaboration with Süring, edited the *Meteorologische Zeitschrift.* It was always a pleasure to meet Schmidt on his visits to England and at the meetings of the International Meteorological Organization; his high-pitched voice and cheery smile will be greatly missed when the International Meteorological Committee meets in Salzburg later in the year.

G. C. Simpson.

Prof. A. A. Kaminsky.—We regret to learn of the death on August 5th, 1936, of Prof. Kaminsky, the well-known Russian climatologist. Kaminsky was born on November 17th, 1862, in Vitebsk and studied at the University of St. Petersburg. In 1887 he joined the staff of the Central Physical Observatory. He published a number of climatological studies of Russia and Siberia, of which the best known are his discussions of the data of humidity and pressure. In 1922 he was Professor at the Agricultural Institute, Leningrad, as well as head of the Climatological section of the Observatory.

NEWS IN BRIEF

Three lectures on Cosmic Rays will be given on Monday evenings, January 18th and 25th, and February 1st, at 8 o'clock, at the Royal Society of Arts, John Street, Adelphi, W.C.2. The lecturer will be Professor P. M. S. Blackett, M.A., F.R.S., Professor of Physics at Birkbeck College. Applications for tickets should be made to the Secretary, Royal Society of Arts.

The Gold Medal of the Royal Astronomical Society has been awarded to Dr. Harold Jeffreys, F.R.S., Reader in Geophysics in the University of Cambridge, for his researches into the physics of the earth and other planets, and for his contributions to the study of the origin and age of the solar system.

Staff News.—Mr. C. W. Atkins, who for the past thirteen years had been storekeeper in the Instruments' Division of the Meteorological Office, retired after sixteen years' service on November 11th, 1936. The instrument store at South Kensington is in the basement of the building; Mr. Atkins, therefore, was not often seen

in his work except by those of his colleagues who had business with him, but his efficiency in the management of the store and supervision of the packing of instruments has contributed in no small degree to the smooth working of the instruments branch for many years. Mr. Atkins' forceful personality and cheery nature will be missed by all who knew him.

On November 14th, 1936, Mr. C. E. Goad retired after forty-seven years' service on the staff of the Meteorological Office. He was appointed in 1889 when the Office was situated in Victoria Street, Westminster, and the earlier years of his career were associated with the work of distribution of weather reports to subscribers and the press, until in 1915 when he was promoted to the grade of Office Keeper. After the War he was selected for transfer to the established clerical staff, and served from that time in the General Services section at the Kensington office. His retirement was made the occasion of a presentation from the Director and staff of the office in recognition of his long and valued service.

The Weather of December, 1936

The pressure distribution during December shows a deep low (below 990 mb.) centred over Spitsbergen, where the mean was 21 mb. below normal, and extending across Iceland. A steep gradient for westerly or south-westerly winds ran from north of Newfoundland across the Atlantic and northern Europe to Siberia ; in Sweden, for example, pressure was slightly above normal in the south and about 13 mb. below normal in the north. A belt of high pressure extended from the eastern United States across the Azores and southern Europe to southern Siberia ; pressure was above normal over the greater part of this belt, the excess reaching 8 mb. over New Brunswick and at Scilly, but the Siberian anticyclone was weaker than usual in December. The broadcast data show mild conditions over western Europe, mean temperatures exceeding 40° F. over the whole of the British Isles, western and southern France and approaching 50° F. in the west. The whole of Europe west of 30° E. was above 30° F. except the extreme north of Scandinavia. In northern Sweden, the temperature was 15° F. or more above normal, and the mean differed little from that for south-eastern Europe which was rather colder than usual. The abnormally high temperatures in the north extended eastwards into Siberia, where Dickson on the Arctic Coast with a temperature of —0·6° F. was 11° F. above normal, and even Verkhoïansk, with a mean of —46° F. was about 5° F. above normal. From the " cold pole " temperatures rose rapidly again towards the Pacific Coast of Siberia. Precipitation was abnormally heavy on the north-western coasts of Europe, the amount for Thorshavn being about 11 inches, but decreased rapidly south-eastwards and in the Balkan Peninsula the totals were generally below one inch.

Disturbed weather persisted over the British Isles during most of the month, with gales at the beginning and in the middle ; temperature and sunshine were generally above normal ; rainfall was generally below normal in England and east Scotland, about normal in Ireland, and above normal in parts of Wales and west Scotland. During anticyclonic weather on the 9th–10th and 23rd–27th, fog developed. Between the 3rd and 5th two depressions passed across northern Scotland and the second was centred over the North Sea on the 6th ; at exposed stations in most parts of the British Isles and especially in the north and west, gales were recorded between the 3rd and 6th. Snow fell in many parts of Scotland between the 3rd and 6th, in Ireland on the 5th, and in parts of England between the 5th and 8th ; it was recorded as far south as Birmingham and Oxford on the 5th and London and Margate on the 6th. The 1st and the 5th–7th were cold in most parts ; at Eskdalemuir the maximum temperature was 37° F. on the 5th and 26° F. on the 7th ; some low minimum temperatures recorded during these few days were 19° F. at Marlborough on the 8th, 18° F. at Auchincruive and 15° F. at Penrith on the 7th ; on the other hand the minimum at Valentia on the 8th was 50° F. Glazed roads were experienced in south-east England and the Midlands on the morning of the 8th, the cold interval being followed by rain and drizzle spreading eastwards during the early hours. The 4th was sunny in many places, Hastings recording 6·8 hours and Cullompton 7 hours of bright sunshine ; again on the 7th, 6·8 hours was recorded at Ross-on-Wye and 7·2 hours at Boscombe Down. By the 9th the British Isles lay in a ridge of high pressure, and fog and mist were prevalent in many parts of England and Scotland ; it recurred in England on the 10th and 11th, but by this time most of Scotland and Ireland were coming under the influence of a deep depression to the north of Iceland. On the 12th a trough of low pressure lay over the British Isles ; snow fell again in some districts on the 11th and 12th. From the 13th–18th the weather was controlled by depressions passing between Scotland and Iceland ; gales were recorded at many coast stations between the 13th and 18th and also at exposed inland stations ; gusts exceeding 90 m.p.h. were registered at Tiree on the 16th and 17th. Rain fell in many districts on the 13th, and some heavy falls were recorded in the west and north, notably 2·86 in. at Bettws-y-Coed, Denbigh, 4·60 in. at Trecastle, Brecon, 2·41 in. at Troutbeck, Cumberland, and 3·75 in. at Oughtershaw, West Riding. On the 17th, 3·55 in. was recorded at Holne, Devon. Snow fell in some northern districts and in northern Ireland between the 13th and 16th. The 17th and 18th were unusually mild for the time of year ; the maximum temperature reached 58° F. at Bath and Chester, and 57° F. at Dublin, York and Manchester on the 17th. On the night of the 17th–18th the minimum temperature was 52° at Kew, Greenwich

and Edgbaston and 53° F. at Ross-on-Wye. On the 20th a deep depression over Iceland caused gales in many parts of the northern half of the British Isles. Day temperatures were rather high on the 20th and 21st in parts of the west and south; the maximum again reached 57° F. at Dublin on the 21st. High pressure to the south over Europe and the Atlantic gradually spread northward, and from the 23rd to the 27th anticyclonic conditions prevailed over most of the British Isles. Fog occurred at Eskdalemuir and Abbotsinch on the 21st, in parts of southern England on the 23rd, and in many districts on the 26th–28th. By the 29th a depression to the north-west of Scotland was affecting the British Isles bringing strong winds and rain to most districts. The distribution of bright sunshine for the month was as follows:—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway ...	12	−10	Chester ...	45	+1
Aberdeen ...	51	+14	Ross-on-Wye ...	53	+5
Dublin	49	+3	Falmouth ...	59	+3
Birr Castle ...	42	−1	Gorleston ...	67	+24
Valentia... ...	33	−5	Kew	59	+22

Miscellaneous notes on weather abroad culled from various sources.

Gales in the English Channel and North Sea during the first few days of the month caused accidents to shipping; nine English fishermen were lost when a trawler was wrecked near Calais on the 1st, and a German ship sank off the Dutch coast on the 2nd. Gales occurred in the North Sea again in the middle of the month; much damage is said to have been done at Bergen. Heavy rain also caused floods at Limassol in Cyprus. (*The Times, December 3rd–16th.*)

Heavy rain in Turkey caused extensive floods near Adana during the first week, and more than 100 people were reported drowned: the town of Adana where the river Seyhan rose 18 ft. suffered severely. A typhoon passed south of Manila in the Philippine Islands on the 2nd; many native houses were blown away. In the north of Luzon heavy rain began on the 2nd and continued until the 6th, when the Cagayen River rose rapidly, flooding over 50 towns and villages. The dam at the Osaruzawa Copper Mine at Akita, Hondo, Japan burst again on the 22nd causing further loss of life. On the Yangste River navigation has been interfered with owing to the river falling 26 ft. below its normal level; the middle river is said to be lower than it has been for 35 years. Heavy rain and snow occurred in many parts of Palestine, Syria, Trans-Jordan and Iraq towards the end of the month. (*The Times, December 8th,* 1936–*January* 1*st*, 1937.)

Rainfall was above normal in New South Wales, Victoria and South Australia, below normal in Northern Territory and variable in amount in Western Australia, Queensland and Tasmania. (*Cable.*)

In the United States at the beginning of the month weather was

generally cold east of the Rocky Mountains, with frequent rains in the south and some snow in northern districts; in the middle of the month weather became warmer, and precipitation was plentiful in eastern districts. During the last week the temperature was well above normal everywhere except on the Pacific coast, being unusually high in the central states; precipitation was mainly below normal except in the west. (*Washington, D.C., U.S. Dept. Agric., Weekly Weather and Crop Bulletin*).

Daily Readings at Kew Observatory, December, 1936

Date	Pressure, M.S.L. 13h.	Wind, Dir., Force 13h.	Temp. Min.	Temp. Max.	Rel. Hum. 13h.	Rain.	Sun.	REMARKS. (see vol. 69, 1934, p. 1).
	mb.		°F.	°F.	%	in.	hrs.	
1	1018·8	W.4	40	47	61	—	0·9	
2	1007·0	WNW.5	42	55	76	0·08	0·0	r–r_0 6h.–8h.
3	1013·6	W.3	50	53	73	—	2·0	
4	1016·6	W.4	48	49	47	—	6·2	
5	1006·6	W.4	39	45	61	0·02	2·5	r_0 6h.–10h., pr_0 13h.
6	1012·1	WNW.5	34	40	76	0·11	0·7	s–rs 1h.–11h.
7	1029·7	NW.3	31	35	63	—	6·3	x early and late.
8	1024·3	SW.2	27	44	97	0·18	0·0	r_0–r 6h.–18h.
9	1029·6	N.2	34	39	100	—	0·0	x early, f 9h.–17h.
10	1026·7	SE.2	36	38	85	—	0·0	r_0 19h.–20h.
11	1015·8	S.2	29	39	90	—	0·0	x early, f 7h.–12h.
12	1008·7	Calm	33	42	89	0·10	0·0	r_0 16h.–21h.
13	1010·4	S.3	30	43	83	trace	6·4	x early, pr_0 16h.
14	986·8	SSW.6	41	51	86	0·50	0·0	r–r_0 0h.–24h.
15	1007·7	SW.3	38	44	71	—	6·2	
16	999·1	WSW.4	40	50	67	0·06	1·4	r 2h.–10h., pr to 17h.
17	1004·2	SSW.4	41	55	94	0·09	0·0	r_0 9h.–20h.
18	1010·8	SW.6	52	54	85	0·10	0·0	r_0–r 1h.–18h.
19	1031·0	SW.3	42	47	70	—	3·5	
20	1026·1	SSW.4	45	49	71	—	2·5	
21	1024·5	S.3	45	49	80	—	0·0	w early.
22	1025·5	SW.3	39	52	84	0·04	2·0	r_0–r 19h.–22h.
23	1039·7	W.2	35	44	83	trace	5·1	x early, f 19h.
24	1036·4	WSW.2	31	42	93	—	0·0	fx till 11h.
25	1035·3	W.2	37	47	79	—	3·9	w early.
26	1034·8	Calm	43	45	99	0·03	0·0	d_0 5h.–20h., f till 15h.
27	1029·2	E.3	41	45	78	—	2·4	
28	1020·6	E.3	32	37	96	0·02	0·0	fd_0 14h.–18h.
29	1016·1	SW.3	37	52	84	0·04	0·5	ir_0 3h.–5h., 15h.–22h.
30	1027·8	SW.2	44	48	77	—	6·2	
31	1025·0	SSW.4	40	48	81	0·01	0·0	w early, r_0 23h.–24h.
*	1019·4	—	39	46	80	1·38	1·9	* Means or totals.

Rainfall, 1936—General Distribution

	Dec.	Year	
England and Wales	90	109	per cent of the average 1881–1915.
Scotland	107	96	
Ireland	104	103	
British Isles ...	97	105	

Rainfall : December, 1936 : England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond	Camden Square	1·87	78	*Leics*	Belvoir Castle	1·61	65
Sur	Reigate, Wray Pk. Rd.	3·72	117	*Rut*	Ridlington	1·86	74
Kent	Tenterden, Ashenden	2·66	86	*Lincs*	Boston, Skirbeck	1·25	58
,,	Folkestone, Boro. San.	2·62	...	,,	Cranwell Aerodrome	1·52	69
,,	Margate, Cliftonville	1·30	57	,,	Skegness, Marine Gdns.	·98	45
,,	Eden'bdg., Falconhurst	3·56	108	,,	Louth, Westgate	1·67	69
Sus	Compton, Compton Ho.	3·13	75	,,	Brigg, Wrawby St.	1·09	...
,,	Patching Farm	2·04	61	*Notts*	Worksop, Hodsock	1·41	60
,,	Eastbourne, Wil. Sq.	2·39	68	*Derby*	Derby, L. M. & S. Rly.	1·74	67
Hants	Ventnor, Roy.Nat.Hos.	2·70	82	,,	Buxton, Terr. Slopes	6·16	109
,,	Fordingbridge, Oaklnds	...	...	*Ches*	Runcorn, Weston Pt.	3·47	110
,,	Ovington Rectory	4·22	107	*Lancs*	Manchester, Whit. Pk.	3·14	97
,,	Sherborne St. John	3·13	95	,,	Stonyhurst College	6·48	134
Herts	Royston, Therfield Rec.	1·76	76	,,	Southport, Bedford Pk.	3·46	107
Bucks	Slough, Upton	1·85	73	,,	Lancaster, Greg Obsy.	5·26	121
,,	H. Wycombe, Flackwell	2·30	76	*Yorks*	Wath-upon-Dearne	1·36	57
Oxf	Oxford, Mag. College	1·86	80	,,	Wakefield, Clarence Pk.	1·32	54
N'hant	Wellingboro, Swanspool	1·72	73	,,	Oughtershaw Hall	8·47	...
,,	Oundle	1·26	...	,,	Wetherby, Ribston H.	2·32	95
Beds	Woburn, Exptl. Farm	1·38	59	,,	Hull, Pearson Park	·91	38
Cam	Cambridge, Bot. Gdns.	1·53	79	,,	Holme-on-Spalding	1·41	57
Essex	Chelmsford, County Gdns	1·79	81	,,	West Witton, Ivy Ho.	5·09	139
,,	Lexden Hill House	1·74	...	,,	Felixkirk, Mt. St. John.	1·76	73
Suff	Haughley House	1·59	...	,,	York, Museum Gdns.	1·30	58
,,	Campsea Ashe	1·24	54	,,	Pickering, Hungate	1·55	62
,,	Lowestoft Sec. School	1·46	63	,,	Scarborough	2·26	95
,,	Bury St. Ed., Westley H.	1·83	76	,,	Middlesbrough	1·13	58
Norf.	Wells, Holkham Hall	1·75	85	,,	Baldersdale, Hury Res.	4·29	116
Wilts	Calne, Castle Walk	2·75	...	*Durh*	Ushaw College	1·88	75
,,	Porton, W.D. Exp'l. Stn	3·28	104	*Nor*	Newcastle, D. & D. Inst.	1·37	63
Dor	Evershot, Melbury Ho.	5·84	113	,,	Bellingham, Highgreen	2·95	81
,,	Weymouth, Westham.	3·11	89	,,	Lilburn Tower Gdns.	1·72	65
,,	Shaftesbury, Abbey Ho.	2·28	63	*Cumb*	Carlisle, Scaleby Hall	3·63	113
Devon	Plymouth, The Hoe	3·40	68	,,	Borrowdale, Seathwaite	19·25	125
,,	Holne, Church Pk. Cott.	13·09	155	,,	Borrowdale, Moraine	19·63	160
,,	Teignmouth, Den Gdns.	4·06	96	,,	Keswick, High Hill	9·28	139
,,	Cullompton	3·65	83	*West*	Appleby, Castle Bank	5·85	148
,,	Sidmouth, U.D.C.	3·18	...	*Mon*	Abergavenny, Larchf'd	6·57	147
,,	Barnstaple, N. Dev.Ath	3·96	89	*Glam*	Ystalyfera, Wern Ho.	8·00	96
,,	Dartm'r, Cranmere Pool	12·70	...	,,	Cardiff, Ely P. Stn.	3·99	78
,,	Okehampton, Uplands.	7·82	111	,,	Treherbert, Tynywaun.	13·95	...
Corn	Redruth, Trewirgie	5·86	94	*Carm*	Carmarthen, Coll. Rd.	5·64	98
,,	Penzance, Morrab Gdns.	3·90	69	*Pemb*	St. Ann's Hd, C. Gd. Stn.	3·60	80
,,	St. Austell, Trevarna	4·95	81	*Card*	Aberystwyth	5·60	...
Soms	Chewton Mendip	4·45	83	*Rad*	BirmW.W.Tyrmynydd	9·83	120
,,	Long Ashton	3·47	90	*Mont*	Lake Vyrnwy	9·27	135
,,	Street, Millfield	2·21	...	*Flint*	Sealand Aerodrome	2·52	...
Glos	Blockley	3·38	...	*Mer*	Blaenau Festiniog	14·09	122
,,	Cirencester, Gwynfa	3·69	110	,,	Dolgelley, Bontddu	8·69	127
Here	Ross, Birchlea	4·12	139	*Carn*	Llandudno	4·43	153
Salop	Church Stretton	4·67	139	,,	Snowdon, L. Llydaw 9.	27·05	...
,,	Shifnal, Hatton Grange	2·34	91	*Ang*	Holyhead, Salt Island	5·63	135
Staffs	Market Drayt'n, Old Sp.	2·18	78	,,	Lligwy	6·02	...
Worc	Ombersley, Holt Lock.	2·50	95	*Isle of Man*			
War	Alcester, Ragley Hall	2·34	95		Douglas, Boro' Cem.	5·88	119
,,	Birminghm, Edgbaston	2·67	99	*Guernsey*			
Leics	Thornton Reservoir	1·70	63		St. PeterP't.Grange Rd.	2·40	59

Rainfall: December, 1936: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Wig .	Pt. William, Monreith.	4·00	88	*Suth* .	Lairg	5·45	135
„ .	New Luce School	5·36	97	„ .	Tongue	3·90	79
Kirk .	Dalry, Glendarroch	6·66	94	„ .	Melvich	3·41	79
Dumf.	Dumfries, Crichton R.I.	5·12	127	„ .	Loch More, Achfary	13·99	151
„ .	Eskdalemuir Obs	9·44	135	*Caith* .	Wick	3·27	106
Roxb .	Hawick, Wolfelee	4·00	96	*Ork* .	Deerness	3·32	79
Selk .	Ettrick Manse	8·65	140	*Shet* .	Lerwick	3·89	81
Peeb .	West Linton	3·38	...	*Cork* .	Dunmanway Rectory	7·67	95
Berw .	Marchmont House	2·11	75	„ .	Cork, University Coll	4·89	95
E.Lot .	North Berwick Res	1·43	67	„ .	Ballinacurra	3·76	73
Midl .	Edinburgh, Blackfd. H.	1·95	83	„ .	Mallow, Longueville	5·59	114
Lan .	Auchtyfardle	4·94	...	*Kerry*.	Valentia Obsy	7·12	107
Ayr .	Kilmarnock, Kay Pk	6·11	...	„ .	Gearhameen	17·10	137
„ .	Girvan, Pinmore	5·87	98	„ .	Bally McElligott Rec	4·54	...
„ .	Glen Afton, Ayr San.	9·78	153	„ .	Darrynane Abbey	5·84	99
Renf .	Glasgow, Queen's Pk	6·13	145	*Wat* .	Waterford, Gortmore	4·30	94
„ .	Greenock, Prospect H.	9·90	125	*Tip* .	Nenagh, Cas. Lough	5·24	114
Bute .	Rothesay, Ardencraig	7·65	140	„ .	Roscrea, Timoney Park	4·07	...
„ .	Dougarie Lodge	5·37	98	„ .	Cashel, Ballinamona	4·38	102
Arg .	Ardgour House	19·85	...	*Lim* .	Foynes, Coolnanes	5·07	107
„ .	Glen Etive	...	...	„ .	Castleconnel Rec	4·04	...
„ .	Oban	9·83	...	*Clare* .	Inagh, Mount Callan	10·60	...
„ .	Poltalloch	9·48	149	„ .	Broadford, Hurdlest'n.	...	...
„ .	Inveraray Castle	18·10	182	*Wexf* .	Gorey, Courtown Ho	4·21	110
„ .	Islay, Eallabus	6·77	114	*Wick* .	Rathnew, Clonmannon.	3·18	...
„ .	Mull, Benmore	...	...	*Carl* .	Hacketstown Rectory	3·12	76
„ .	Tiree	4·59	88	*Leix* .	Blandsfort House	3·51	95
Kinr .	Loch Leven Sluice	3·52	89	*Offaly*.	Birr Castle	3·13	95
Fife .	Leuchars Aerodrome	1·57	64	*Dublin*	Dublin, FitzWm. Sq.	2·38	96
Perth .	Loch Dhu	13·40	133	*Meath*.	Beauparc, St. Cloud	3·51	...
„ .	Balquhidder, Stronvar.	...	...	„ .	Kells, Headfort	3·67	96
„ .	Crieff, Strathearn Hyd.	4·83	108	*W.M* .	Moate, Coolatore	2·80	...
„ .	Blair Castle Gardens	5·24	137	„ .	Mullingar, Belvedere	3·64	99
Angus.	Kettins School	3·24	98	*Long* .	Castle Forbes Gdns	4·13	104
„ .	Pearsie House	3·12	...	*Gal* .	Galway, Grammar Sch.	4·94	108
„ .	Montrose, Sunnyside	...	...	„ .	Ballynahinch Castle	8·52	114
Aber .	Braemar, Bank	4·09	115	„ .	Ahascragh, Clonbrock.	4·74	101
„ .	Logie Coldstone Sch	...	...	*Mayo*.	Blacksod Point	8·31	136
„ .	Aberdeen, Observatory.	1·98	61	„ .	Mallaranny	7·98	...
„ .	Fyvie Castle	1·79	52	„ .	Westport House	7·22	126
Moray	Gordon Castle	1·27	47	„ .	Delphi Lodge	14·08	116
„ .	Grantown-on-Spey	2·24	83	*Sligo* .	Markree Castle	5·25	110
Nairn.	Nairn	2·59	117	*Cavan*.	Crossdoney, Kevit Cas.	3·80	...
Inv's .	Ben Alder Lodge	9·93	...	*Ferm* .	Newtwnbtlr, Crom Cas.	4·31	104
„ .	Kingussie, The Birches.	5·30	...	„ .	Enniskillen, Portora	...	...
„ .	Loch Ness, Foyers	7·91	179	*Arm* .	Armagh Obsy	3·21	103
„ .	Inverness, Culduthel R.	3·47	129	*Down*.	Fofanny Reservoir	5·47	...
„ .	Loch Quoich, Loan	25·27	...	„ .	Seaforde	2·97	72
„ .	Glenquoich	21·25	145	„ .	Donaghadee, C. G. Stn.	3·45	108
„ .	Glenleven, Corrour	8·72	94	*Antr* .	Belfast, Cavehill Rd	4·09	...
„ .	Fort William, Glasdrum	18·68	...	„ .	Aldergrove Aerodrome.	3·74	109
„ .	Skye, Dunvegan	10·64	...	„ .	Ballymena, Harryville.	5·07	114
„ .	Barra, Skallary	5·28	...	*Lon* .	Garvagh, Moneydig	4·74	...
R&C .	Alness, Ardross Castle.	5·22	126	„ .	Londonderry, Creggan.	4·92	112
„ .	Ullapool	7·72	123	*Tyr* .	Omagh, Edenfel	5·96	141
„ .	Achnashellach	...	...	*Don* .	Malin Head	3·47	...
„ .	Stornoway, Matheson	8·63	138	„ .	Killybegs, Rockmount.	3·01	...

Climatological Table for the British Empire, July, 1936

STATIONS.	PRESSURE. Mean of Day M.S.L. (mb.)	PRESSURE. Diff. from Normal. (mb.)	TEMPERATURE. Absolute. Max. (°F.)	TEMPERATURE. Absolute. Min. (°F.)	TEMPERATURE. Mean Values. Max. (°F.)	TEMPERATURE. Mean Values. Min. (°F.)	TEMPERATURE. Mean Values. ½ Max. and Min. (°F.)	TEMPERATURE. Mean Values. Diff. from Normal (°F.)	TEMPERATURE. Mean. Wet Bulb. (°F.)	Relative Humidity. (%)	Mean Cloud Am'nt (0–10)	PRECIPITATION. Am'nt. (in.)	PRECIPITATION. Diff. from Normal. (in.)	PRECIPITATION. Days.	BRIGHT SUNSHINE. Hours per day.	BRIGHT SUNSHINE. Per-cent-age of possi-ble.
London, Kew Obsy....	1010·6	− 5·2	76	48	68·5	55·4	61·9	− 0·9	56·3	84	7·7	2·35	+ 0·18	20	4·5	28
Gibraltar	1017·2	+ 0·4	84	63	76·8	64·9	70·9	...	63·6	79	2·2	0·07	...	1	...	...
Malta........	1015·4	+ 0·7	96	66	83·8	71·4	77·6	− 0·7	69·2	67	0·9	0·00	− 0·05	0	12·9	90
St. Helena	1017·8	+ 0·4	67	52	60·5	54·3	57·4	− 1·1	55·4	91	8·6	3·44	− 0·63	20	...	...
Freetown, Sierra Leone	1014·4	+ 3·4	84	68	80·8	70·9	75·9	...	73·3	88	8·6	25·03	− 10·55	25	...	...
Lagos, Nigeria	1015·3	+ 2·1	84	71	81·3	74·0	77·7	− 0·3	73·2	86	8·8	0·16	− 10·34	5	4·8	39
Kaduna, Nigeria	1010·4	...	88	65	82·8	68·8	75·8	+ 2·2	70·7	90	8·8	6·02	− 4·60	18	5·1	40
Zomba, Nyasaland	1019·5	+ 0·9	80	51	71·8	54·3	63·1	+ 1·1	58·2	72	5·5	0·12	− 0·23	4	...	...
Salisbury, Rhodesia...	1024·3	+ 1·9	82	37	69·3	44·3	56·8	+ 0·7	49·0	57	3·1	0·02	− 0·01	2	8·5	76
Cape Town	1021·9	+ 0·6	81	40	64·9	49·7	57·3	+ 2·6	49·5	81	4·3	2·26	− 1·36	7	...	...
Johannesburg	1024·6	+ 0·7	69	32	60·5	40·7	50·6	+ 0·2	41·0	52	1·1	0·04	− 0·29	1	8·9	83
Mauritius	1021·8	+ 1·4	77	55	74·3	62·6	68·5	+ 0·2	63·7	72	5·6	1·30	− 1·19	22	7·1	65
Calcutta, Alipore Obsy.	999·3	+ 0·1	93	77	89·0	79·8	84·4	+ 0·7	80·1	91	8·9	10·73	− 1·97	16*	...	...
Bombay	1004·5	+ 0·6	88	76	86·6	77·4	82·0	+ 0·6	77·5	84	8·8	8·09	− 16·18	24*	...	...
Madras	1004·0	− 0·5	100	74	94·8	79·2	87·0	− 0·6	76·3	71	8·0	4·87	+ 1·03	6*	...	...
Colombo, Ceylon	1009·7	+ 0·6	85	72	84·4	77·8	81·1	− 0·1	76·2	77	8·1	1·88	− 2·55	12	5·2	42
Singapore........	1009·2	+ 0·3	89	71	86·1	77·7	81·9	+ 0·6	77·7	80	6·3	4·88	− 1·91	12	6·8	56
Hongkong........	1005·2	− 0·5	92	76	88·6	79·3	83·9	+ 1·4	79·4	79	6·9	8·81	− 5·61	20	8·0	60
Sandakan	1008·6	...	90	73	88·1	75·2	81·7	− 0·1	76·4	83	7·7	10·41	+ 3·69	13	...	...
Sydney, N.S.W........	1019·9	+ 1·6	68	41	62·6	46·4	54·5	+ 1·8	48·6	74	3·4	0·84	− 3·96	9	6·2	61
Melbourne	1019·4	+ 0·5	65	37	56·4	43·1	49·7	+ 1·0	45·6	83	7·0	4·41	+ 2·55	24	3·3	34
Adelaide	1020·0	− 0·3	68	39	59·7	46·1	52·9	+ 1·1	48·5	79	7·7	2·30	− 0·34	18	3·5	35
Perth, W. Australia ...	1019·7	+ 0·7	68	39	62·4	46·8	54·6	− 0 6	48·7	79	5·8	4·89	− 1·67	20	5·6	55
Coolgardie	1020·2	+ 0·3	73	33	60·7	40·8	50·7	− 0·5	44·7	66	3·9	1·15	+ 0·28	7	...	...
Brisbane........	1021·5	+ 3·1	75	40	68·5	51·0	59·7	+ 1·2	53·0	72	4·7	1·31	− 0·89	8	6·2	58
Hobart, Tasmania......	1017·3	+ 3·6	60	33	52·5	41·5	47·0	+ 1·3	42·0	75	6·2	1·20	− 0·98	17	3·9	42
Wellington, N.Z.	1013·2	− 0·7	58	34	50·2	41·1	45·7	− 2·3	42·9	80	7·3	8·42	+ 2·79	21	3·4	36
Suva, Fiji	1015·2	+ 1·2	86	66	79·0	69·9	74·5	+ 1·1	69·3	82	7·4	3·37	− 1·56	22	4·1	37
Apia, Samoa	1011·9	0·0	86	68	84·3	73·5	78·9	+ 1·7	75·1	79	4·6	3·15	+ 0·17	11	7·5	66
Kingston, Jamaica	1013·6	− 1·1	92	72	89·4	74·3	81·9	+ 0·2	73·3	79	3·6	0·97	− 0·65	4	7·7	59
Grenada, W.I.	1011·7	− 1·6	88	70	85	73	79·0	− 0·2	73	74	6	10·13	+ 0·70	20	...	...
Toronto........	1013·0	− 1·4	105	52	84·1	62·2	73·1	+ 4·0	61·9	65	3·3	0·77	− 2·07	3	11·4	76
Winnipeg	1011·9	− 0·4	108	43	88·6	62·4	75·5	+ 9·1	62·2	79	3·2	1·87	− 1·23	7	10·6	67
St. John, N.B.	1010·4	− 3·2	82	49	69·3	53·1	61·2	+ 0·8	57·3	82	6·3	2·33	− 1·30	14	7·6	50
Victoria, B.C........	1016·2	− 1·1	74	51	67·7	53·2	60·5	+ 0·4	56·3	79	3·5	0·85	+ 0·43	6	11·2	71

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

(35267) Wt. 19/32 1125 1/37 Hw. G.377

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St. John, N.B.	1010·4	− 3·2	82	49	69·3	53·1	61·2	+ 0·8	57·3	82	6·3	2·33	− 1·30	14	7·6	50
Victoria, B.C.	1016·2	− 1·1	74	51	67·7	53·2	60·5	+ 0·4	56·3	79	3·5	0·85	+ 0·43	6	11·2	71

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